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Research on smart campus construction based on big data

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Abstract: The smart campus is one of the key aspects of modernizing education. This article summarizes the existing research results and proposes solutions to the problems existing in the current smart campus construction, such as incomplete evaluation index system and lack of effective application of big data. This article combines big data, artificial intelligence and other emerging information technologies to propose solutions. Specifically, the application of big data in smart campus construction is realized through three aspects: system construction, evaluation system improvement, and big data application. The proposed scheme has been applied in the construction of smart campuses in specific colleges and has achieved good results. The research conclusions of this article can provide practical case references for the construction of smart campuses in the AI era.

1. Introduction

With the development of the new generation of information technology, campus digital construction has entered a new stage, including the construction of a digital campus. The country has always attached great importance to the application of information technology, especially big data, in the field of education. The construction of a digital campus provides sufficient educational big data for school information system applications. The educational big data analysis process involves using artificial intelligence, blockchain, machine learning, and other intelligent algorithms to conduct data mining on big data, thereby discovering the hidden information within the data. This useful information will ultimately serve the campus's intelligent decision-making. Therefore, according to the requirements of smart campus construction, big data analysis technology is used to serve talent training, discipline construction, teacher training, and management efficiency improvement. For this purpose, this article first summarizes the current research status of smart campus construction and identifies existing problems. Then it puts forward the construction goals for the existing problems. Finally, an implementation plan for smart campus construction is proposed. The research results provide practical cases for the construction of smart campuses in the AI era.

2. Research status and existing problems

2.1. Research status

Theoretical framework research. By using literature and case analysis methods, Xie Youru (2021) clarifies the core connotation of smart campus construction from the perspective of information literacy, and use this as a basis to propose the core content of building a smart campus and propose new developments in smart campus application and research [1]. Xiong Pin (2015) takes a foreign university as an example, expounds the design principles and overall construction framework of smart campus construction, emphasizes the importance of interactive methods centered on social network applications in the construction of smart campuses, and proposes specific construction strategies [2]. Hu Xujue (2019) summarizes the hot spots and development trends of smart education are summarized, and the shortcomings of China's smart education focusing on technology and ignoring connotation are pointed out [3]. Yu Peng (2018) build a new ecological system for smart campus construction based on educational big data. This system brings together functions such as management modernization, intelligent teaching , scientific research, and scientific decision-making [4]. Yang Ping (2019) summarizes the five current framework systems for smart campus construction are summarized and provide reference cases for smart campus construction [5]. Wu Minyu (2015) comprehensively reviews the current situation of smart campus construction, proposed the key factors affecting the implementation of construction are pointed out [6].

Practice framework research. From a technical perspective, Jiang Dongxing (2015) proposes the main method to conduct research on key technologies of smart campuses in universities is based on the computer system architecture design of smart campuses under the background of big data [7]. Li Youzeng (2021) discusses similar practical cases, including responses to the problem of insufficient data application in current smart campus construction. He emphasizes the importance of addressing data application issues in the smart campus system to improve teaching efficiency, help students learn, and assist teachers by integrating big data into the system[8]. Liu YL (2014) proposes a new campus information system based on the Internet of Things and cloud computing. The system included the network basic platform, service platform and intelligent application platform. The author explains and discusses issues that should be paid attention to in the construction of smart campus are discussed [9]. JURVA *R* (2020) proposes the technical architecture of the future smart campus, including 5G and IoT networks, supplemented by distributed computing and data analysis, and design a new smart campus operation model by proposing the concept of micro-operators. In addition, the case of the University of Oulu campus is introduced , in which intelligent management is implemented in the form of 5G test network [10]. AHMED V (2020) proposes a set of comprehensive standards to identify smart campuses, which are defined from a literature review. Taking the smart campus construction of a university as an example, with campus stakeholders as the content, the framework supporting smart campus construction is evaluated. AHMED V pointed out that in methods of using smart campuses in higher education environments[11]. LIU X (2022) briefly introduces the concept and necessity of smart campus construction, analyze the role of big data technology in smart campus construction, and propose smart campus construction measures based on big data [12]. The rapid development of science and information technology such as the Internet of Things has led to an increasing number of studies on the technological construction of smart cities, especially smart campuses. ALKHAMMASH M (2020) reviewed the concept of smart campus, discussing its main technologies, and then proposing a new smart campus framework. The framework with a special examination of security is discussed combined privacy systems, Internet of Things, and blockchain technology [13]. VILLEGAS-CH (2019) proposed to integrate the Internet of Things, big data and other technologies into traditional university campuses. This method is mainly characterized by

acquiring data through the Internet of Things, concentrating data in proprietary infrastructure, and using big data for data management and analysis[14].

2.2. Problems exist

From a summary of the current research status, it can be seen that the application of big data in smart campus construction has been studied from multiple angles at home and abroad, and corresponding research results have been achieved. However, the following aspects still need further research:

Among the existing research, there are few studies on the development of a quantitative evaluation index system for smart campuses. The smart campus represents the latest evolution of information-based campus environments. How to objectively evaluate its effect has become one of the key issues in the construction of a smart campus. Given the current research landscape, establishing clear evaluation indicators and systems is particularly important.

At present, there is a scarcity of research, both domestically and internationally, on the application of big data in smart campuses. Current research predominantly comprises scattered case studies, with a notable absence of studies exploring this topic from a macro perspective. Researching the macro development trends in smart campus construction is of crucial guiding significance. However, current research mainly focuses on micro-level outcomes, with a paucity of macro-level evaluations results, which will inevitably affect the sustainability of smart campus construction. Therefore, it is necessary to conduct research on the macro development trend of smart campuses.

Presently, the focus is predominantly on theoretical exploration, with a shortage of case studies on practical applications. The application of big data in smart campuses primarily leverages advanced artificial intelligence technologies, such as machine learning, blockchain, etc. Only through practical applications can the role of smart campuses in promoting the modernization of school management be fully reflected.

This article aims to conduct research addressing the identified shortcomings in the current research landscape, and strive to achieve new research results in theoretical research and practical applications.

3. Research objectives

This article applies big data technology to study the comprehensive management of a smart campus. One of the research goals of this project is to use the internet search index (a form of network big data) to study the research status and future development trends of smart campus construction. Subsequently, the analytic hierarchy process and comprehensive analysis methods are applied to construct a smart campus evaluation system for higher vocational colleges. The paper categorizes aspects of campus management based on smart campus big data. Modeling research is conducted by constructing models for campus public management, financial management for teachers and students, library management, and other topics, all based on big data. By combining management and economic variables, this paper quantitatively studies the management issues of smart campus construction in higher vocational colleges and, based on the research conclusions, puts forward policy recommendations.

3.1. Construct smart campus functional application evaluation indicators

Starting with the construction requirements of the digital campus evaluation system for vocational colleges, the study aims to construct an implementable digital campus cognitive index and evaluation system. Additionally, the paper seeks to develop a smart campus cognitive index evaluation system tailored to the needs of higher vocational colleges. As there are currently no mature indicator systems

for reference, it is necessary to consider the common development characteristics of higher vocational colleges, taking into account the unique situation of each school. The construction of the indicator system closely revolves around the guiding principles of "co-construction, co-governance, and sharing". In summary, smart campus construction can should aim to develop an appropriate index evaluation system based on specific objective conditions. The evaluation system should not only highlight key areas and challenges but also be flexible and amenable to improvements.

3.2. Study the macro development trends of smart campuses

The paper studies the macro development trends of smart campuses, understands the public attention and influencing factors of smart campuses, and provides reference for realizing the sustainable development of smart campuses. It constructs a system of influencing factors for public attention based on big data. One of the key issues to be solved when constructing the influencing factors of public attention in smart campuses based on big data is to find alternative variables for public attention indicators. This project utilizes the Baidu Index and Google Index as substitute variables for measuring public attention in China and abroad. By integrating management theory and economic theory, the economic impact indicators of national and global attention to smart campuses are determined. Finally, a spatial econometrics model is employed, and the resultant effects are analyzed.

3.3. Realize the practical application of big data in campus management

The paper proposes the application of big data technology (machine learning, blockchain, cloud computing, etc.) to teacher teaching quality assessment, student learning satisfaction survey, and school routine management modernization transformation. The school management initially achieves intelligence. The paper proposes to conduct research on the integration of big data and specific management affairs. The big data for this project comes from the smart campus network. How to integrate big data with the various management modules of the smart campus system for modeling has become the core issue of this project. The solution is to apply intelligent algorithms such as neural networks, deep learning, logistic regression, decision trees, and rough sets to perform modeling operations based on different management modules to obtain decision-making results such as automatic classification and clustering.

4. Construction plan

4.1. System construction and implementation basis

Developing supporting systems is a prerequisite for implementing smart campus construction.In order to ensure the success of smart campus construction, the construction of supporting management systems is essential. This includes personnel security construction; the construction team needs to have practical experience in information construction. In addition, it is necessary to continuously improve the theory of campus informatization construction and guide practice, and to explore informatization construction theories that align with the needs of current vocational colleges.

Improving hardware conditions is another foundation for successfully building a smart campus. Smart campus hardware construction includes the construction of backbone 10G fiber optic lines, wireless access points, 10G firewalls, anti-virus walls, hyper-converged all-in-one machines, and bastion machine central computer rooms. In addition, before the intelligence build, a data center needs to be built, which includes five major platforms: master data management platform, unified identity authentication platform, application management platform, service open platform, and process

management platform.

4.2. Build a scientific evaluation system

In order to achieve the sustainability of smart campus construction, it is necessary to conduct a quantitative analysis of the public attention of smart campuses and its influencing factors. The smart campus has become the main form of information construction in schools, and has attracted widespread attention both domestically and internationally. The research method is based on using Chinese and English search indices as indicators of public attention.The spatial and temporal distribution and influencing factors are analyzed to understand the future development direction of smart campuses.

At the same time, in order to quantitatively evaluate the effectiveness of smart campus construction, it is necessary for the construction unit to build a digital campus evaluation system. The indicators of the evaluation system must possess characteristics such as objectivity, completeness, guidance, and scientific rigor. The research evaluation system comprises four levels of indicators, with scores and scoring standards established based on the actual situation.

In the era of the digital economy, many industries, especially the Internet, digital government, and enterprise digital transformation, have commonly used evaluation indexes as core observation indicators. The introduction of evaluation indexes into the digital campus evaluation system represents an innovative task. A major focus of this research project is how to compile and publish evaluation indexes, with the design of the index data model being its core content. The specific research method involves extracting key attributes and construct a low-dimensional evaluation index by using principal component analysis.

4.3. Realize the practical application of big data in campus management

The paper proposes the application of big data technology (machine learning, blockchain, and cloud computing) to school management. The research approach involves initially extracting educational big data through the smart campus system, and subsequently applying it to relevant aspects of school management. The research encompasses areas such as evaluating teacher teaching quality, conducting student learning satisfaction surveys, and transforming routine management for modernization.

4.3.1. Teacher information management application

The paper analyzes the distribution and trends concerning the overall composition of the faculty, including full-time teachers and senior talents, in the school. The specific research method involves analyzing the influence of teachers' teaching and academic research through big data. The big data analysis technologies used include neural networks and data visualization. By constructing a teacher teaching and academic evaluation index system, and extracting big data from the smart campus system, neural networks are employed to classify teachers’ teaching quality and academic achievements. Finally, the paper applies data visualization technology to display teacher evaluations, providing objective reference data to promote and effectively improve teacher quality.

4.3.2. Student information topic analysis

This paper primarily analyzes the behavior characteristics of students in school.The specific research content involves combining teaching reform efforts, particularly the new teaching modes of flipped classrooms and blended teaching, and use the big data of students' learning behavior collected by smart campus to track and statistically analyze students' learning conditions before, during, and

after class. This paper utilizes intelligent algorithms to analyze students' learning patterns and provide objective evaluations.This paper utilizes intelligent algorithms to analyze students' learning patterns and provide objective evaluations.

4.3.3. Research on the integration of campus card and smart campus

The sharing and utilization of all-in-one card service data are realized through the school's collaborative business processing platform. In terms of specific construction, it can be divided into the following three parts: ① School Public management. The campus card can integrate the daily management of the school with the school's public management, and can organically combine the management affairs of the entire school's teachers and students. Through the smart campus platform, intelligent school management is realized. ② Financial management for teachers and students. Besides assisting management functions, the campus card also has financial management attributes. Through the one-stop card, teachers and students can achieve centralized management of campus consumption, thereby improving management efficiency. ③ Teacher and student library management. Library management is one of the main tasks of daily campus management. Through the construction of smart campus systems, we can further promote the intelligence of library management and improve predictability. The specific research question involves using big data to intelligently analyze book borrowing and reading habits, and to understand and track the reading needs and trend predictions of teachers and students. The specific construction involves mobile communication technology, cloud computing and Internet of Things technology. Mobile communication technology facilitates user identification for all-in-one cards, cloud computing handles data storage and computation for smart campus systems, and Internet of Things technology is utilized for managing school fixed assets, among other applications.

5. Conclusion

Based on the shortcomings of current smart campus construction, this article proposes a big data-based smart campus construction plan, providing a specific framework that ranges from hardware configuration and software design to system construction. This program has been implemented in a higher vocational college, where it has achieved preliminary results. Through the construction of smart campuses, school management optimization and more efficient use of school resources have been achieved. The construction helps to improve teaching practices and enables personalized teaching based on student feedback. The smart campus system allows for dynamic control of student behavior and provides quantitative reference data to better serve students. Overall, the effectiveness of the construction plan proposed in this article has been proven in practice. Follow-up research will continue to refine the plan based on existing constructions, aiming to achieve dynamic development and management of smart campus construction and provide practical case studies.

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